Attorney's Docket No.: 10010716-1

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant : David G. Cunningham et al.
Serial No. : 09/991,570
Filed : November 16, 2001
Title : Open Fiber Control for Optical Transceivers

Art Unit : 2633
Examiner : Phan, Hanh

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

DECLARATION UNDER 37 CFR § 1.131

We, David G. Cunningham, Frederick W. Miller, Jiang Wang, and Janet L. Yun hereby declare as follows.

1. We are the inventors of the subject matter recited in the pending claims of the above-identified patent application.

2. Prior to February 9, 2001, we conceived our invention as described and claimed in the above-identified patent application in this country.

a. Prior to February 9, 2001, we conceived the idea of a method and an optical transceiver for performing open fiber control for at least one optical transceiver in an optical network. In accordance with this idea, output signals are simultaneously transmitted on respective output channels. A loss of signal is detected. In response to a successful detection of the loss of signal, the transmitting of one of the an output signals is maintained on a designated one of the output channels while disabling the transmitting of the output signals on all but the designated one of the output channels. In response to a failure to detect

CERTIFICATE OF MAILING

I hereby certify that this correspondence is being deposited with the United States Postal Service as First Class Mail in an envelope addressed to: Commission for Patents, PO Box 1450, Alexandria, VA 22313-1450 on:

February 14, 2006
Date

(Signature of person mailing papers)

Edouard Garcia
(Typed or printed name of person mailing papers)

the loss of signal, the transmission of the output signals whose transmission had previously been disabled is re-enabled.

b. Prior to February 9, 2001, we additionally conceived an extension of the idea of ¶ 2.a in accordance with which, in response to a successful detection of the loss of signal by the receiver, the output signal is transmitted on the designated output channel at a predetermined power level up to a specified maximum eye-safe power level.

c. Prior to February 9, 2001, we additionally conceived an extension of the idea of ¶ 2.a in accordance with which the output signals are transmitted on the respective output channels at a total power level above the predetermined power level.

d. Prior to February 9, 2001, we additionally conceived an extension of the idea of ¶ 2.a in accordance with which each of the output signals is transmitted at or above a specified maximum eye-safe power level.

e. Prior to February 9, 2001, we additionally conceived an extension of the idea of ¶ 2.a in accordance with which the output signals are transmitted on the respective output channels at a total power level above the predetermined power level.

f. Prior to February 9, 2001, we additionally conceived an extension of the idea of ¶ 2.a in accordance with which the output signals are simultaneously transmitted on respective optical fibers at a data rate up to and greater than 1 Gbps.

3. Prior to February 9, 2001, Frederick W. Miller prepared a written description of a test board capable of implementing the idea of ¶ 2 on the pages of a laboratory notebook that are attached hereto as Exhibit A.

a. The first page of Exhibit A (numbered "5") is dated prior to February 9, 2001, and shows:

i. a block diagram of the test board that includes four transmit (TX) channels, four receive (RX) channels, a TX Disable logic block, and an OFC logic block for implementing the open fiber control idea of ¶ 2;

ii. truth tables describing the logic functions implemented by the TX Disable block and the OFC logic block; and

iii. a logic gate implementation of the OFC logic block.

b. The second page of Exhibit A shows a circuit diagram of the test board, including a transmitter integrated circuit, a receiver integrated circuit, and power, ground and signal lines.

c. The third page of Exhibit A (numbered "7") shows a physical layout of the test board.

d. The date deleted from the first page of Exhibit A is prior to February 9, 2001.

4. Prior to February 9, 2001, a physical embodiment of the optical transceiver of ¶ 2 was made in accordance with the written description of ¶ 3.

a. The image of Exhibit B corresponds to a photograph of a prototype printed circuit board containing circuitry for implementing the physical embodiment of the optical transceiver of ¶ 2, including the transmitter integrated circuit, the receiver integrated circuit, and the power, ground and signal lines.

b. The image of Exhibit C shows a close-up view of a portion of the printed circuit board shown in the image of Exhibit B.

c. The dates of the images of Exhibits B and C are all prior to February 9, 2001.

5. In January 2001, we tested the functionality of the TX and RX channels of the prototype printed circuit board of ¶ 4 on which was mounted the transmitter integrated circuit and the receiver integrated circuit. The results of these tests demonstrated that the components

of the prototype test board, including the power, ground and signal lines, all were in proper working order.

a. The results of measurements on the TX channel of the prototype printed circuit board of ¶ 4 are reported in the e-mail of Exhibit D, which was sent by Jing Wang on January 25, 2001. In particular, this e-mail reports that the TX channel of the prototype printed circuit board of ¶ 4 (referred to as the "Open Fiber Control board") "seems to be working OK" as evidenced by the eye diagrams shown in the images of Exhibit E.

b. The results of measurements on the RX channel of the prototype printed circuit board of ¶ 4 are reported in the e-mail of Exhibit F, which was sent by Jing Wang on January 30, 2001. In particular, this e-mail reports that after correcting a wirebonding problem the RX channel of the prototype printed circuit board of ¶ 4 (referred to as the "Open Fiber Control module") was working as evidenced by the eye diagram shown in the image of Exhibit G. The e-mail of Exhibit F reports that, after having shown the operability of the prototype printed circuit board of ¶ 4, all that remained was to mount the optical sub-assembly (OSA) on the RX channel and complete the board assembly and demonstrate open fiber control (OFC).

c. The dates of the images of Exhibits E and G are all prior to February 9, 2001.

d. Telephone numbers listed in the e-mails of Exhibits D and F have been deleted.

6. Prior to February 9, 2001, we constructed a test set-up that included a customized alignment fixture that would be used to align optical fibers with respect to the prototype printed circuit board of ¶ 5 during mounting of the OSA on the RX channel of the prototype printed circuit board of ¶ 5.

a. The image of Exhibit H shows the alignment fixture.

b. The image of Exhibit I shows the test set-up, which includes the alignment fixture of ¶ 6.a.

c. The dates of the images of Exhibits H and I are all prior to February 9, 2001.

7. On or before April 5, 2001, we operated a completed physical embodiment of the idea of ¶ 2 in a manner demonstrative of the workability of the idea of ¶ 2.

a. The completed physical embodiment included the prototype printed circuit board of ¶ 4, the transmitter integrated circuit, the receiver integrated circuit, and the OSA.

b. The results of testing the completed physical embodiment are described on page 8 of a report entitled "Implementation of Agilent Open Fiber Control," which is attached hereto as Exhibit J.

c. On page 1, lines 6-8, the report of Exhibit J includes the following statement: "The Agilent design is then disclosed, and finally its board-level implementation and testing are presented along with a successful OFC functionality demonstration."

d. On page 8, near the end of section III, the report of Exhibit J includes the following statement: "In summary, the Agilent OFC demonstrated full functionality of open fiber control."

e. The report of Exhibit J was sent by Jing Wang in an e-mail dated April 5, 2001, which is attached hereto as Exhibit K.

f. Telephone numbers listed in the e-mail of Exhibit K have been deleted.

8. We declare that all statements made herein of our own knowledge are true and that all statements made on declaration and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are

punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code, and that such willful false statements may jeopardize the validity of the application or any patent issuing thereon.

Respectfully submitted,

Date: 14/2/2006

David G Cunningham

David G. Cunningham

Date: 2/1/2006

Frederick W. Miller

Frederick W. Miller

Date: 2/1/2006

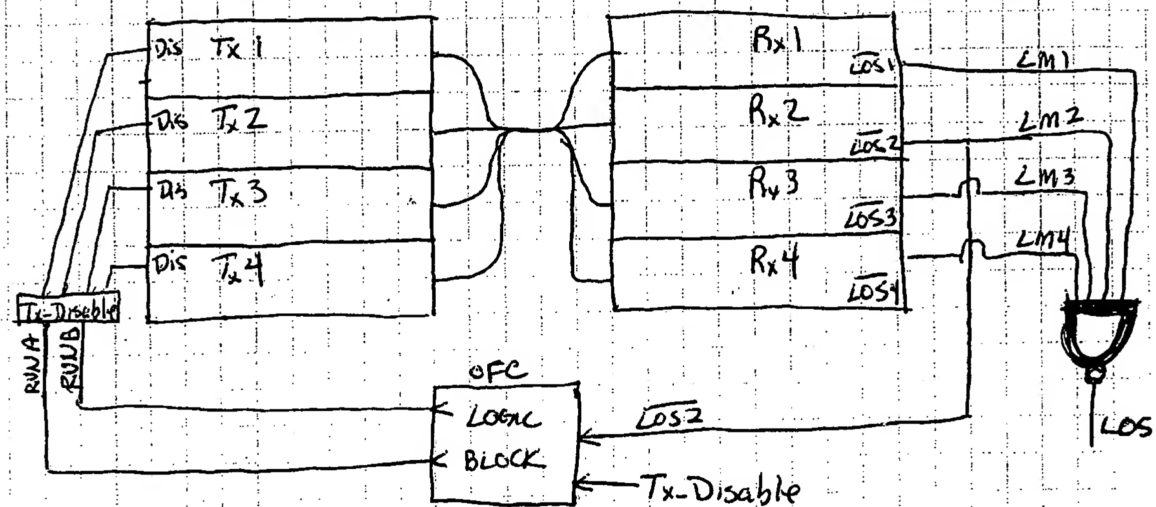
Jing Wang

Date: 2-1-2006

Janet L. Yun

EXHIBIT A

8/7/00 HXT2204 / HRX2204 TEST BOARD



LOGIC BLOCK FOR OPEN FIBER CONTROL

RUN A/ RUN B truth table

RUN A	RUN B	TX1	TX2	TX3	TX4
0	0	off	off	off	off
0	1	on	on	on	on
1	0	off	on	off	off
1	1	off	on	on	off

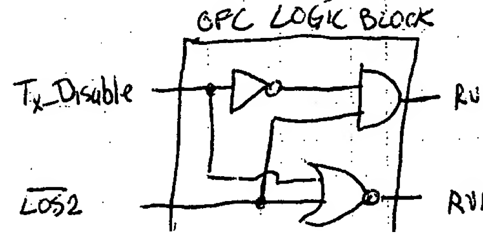
→ TX2 is only channel that can b[e] on by itself

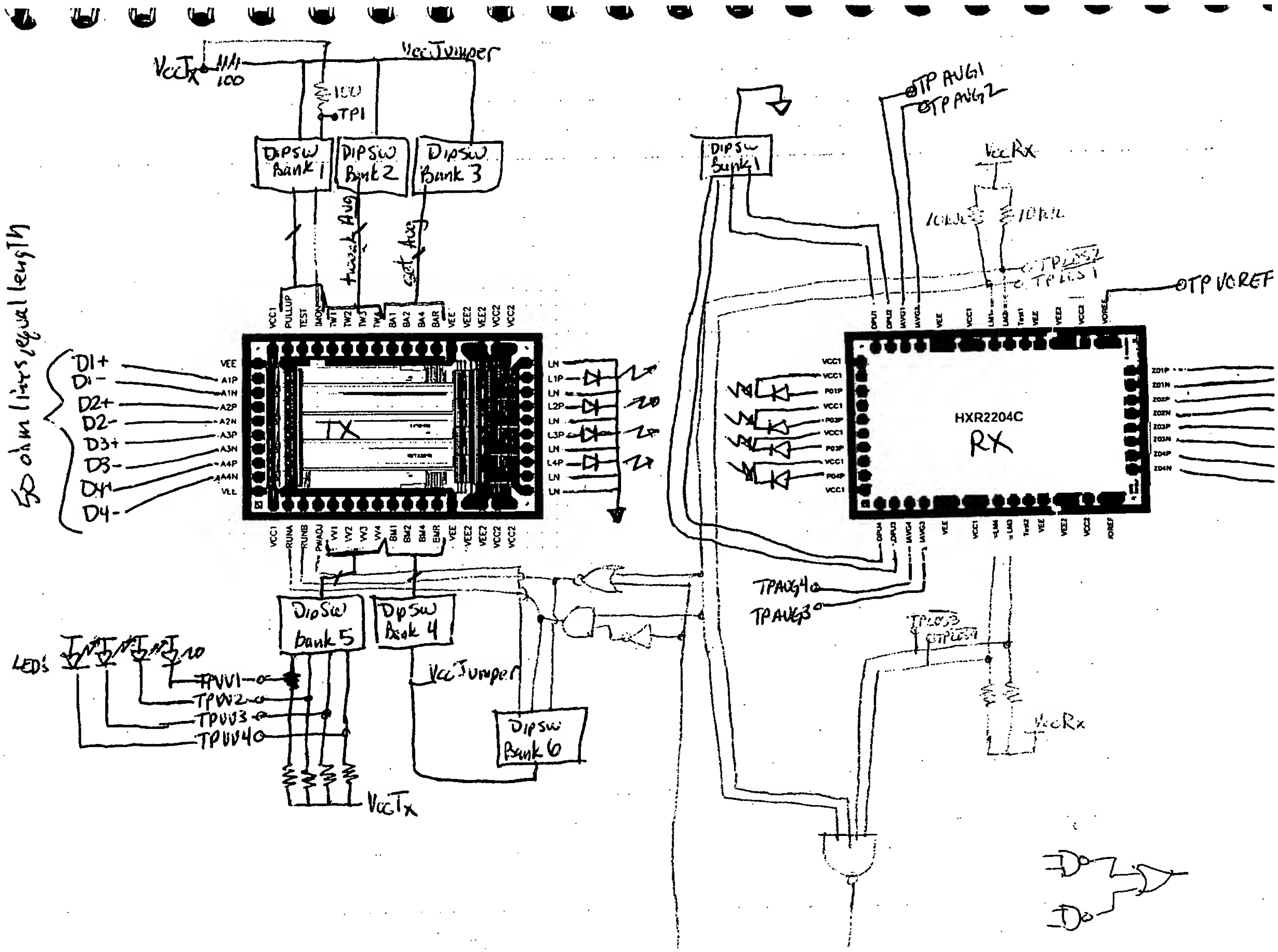
$\overline{LOS2}$	Tx_Disable	RUN A	RUN B	
0	0	0	1	TX2 on only
1	0	1	0	All Tx channels on
0	1	0	0	All Tx channels off
1	1	0	0	All Tx chanels off

RUN A ($\overline{LOS2}$ \ Tx Dis)	0	1
0	0	0
1	1	0

RUN B ($\overline{LOS2}$ \ Tx Dis)	0	1
0	1	0
1	0	0

OFC LOGIC BLOCK





50 ohm lines, equal length
D1+
D1-
D2+
D2-
D3+
D3-
D4+
D4-
TX
HXR2204C
RX
VccTx
100
VccJumper
TP1
DIPSW Bank 1
DIPSW Bank 2
DIPSW Bank 3
DIPSW Bank 4
DIPSW Bank 5
DIPSW Bank 6
tweak Avg
set Avg
LEDs
TPVV1
TPVV2
TPVV3
TPVV4
TPAVG1
TPAVG2
TPAVG3
TPAVG4
VccRx
10kΩ
TP VOREF

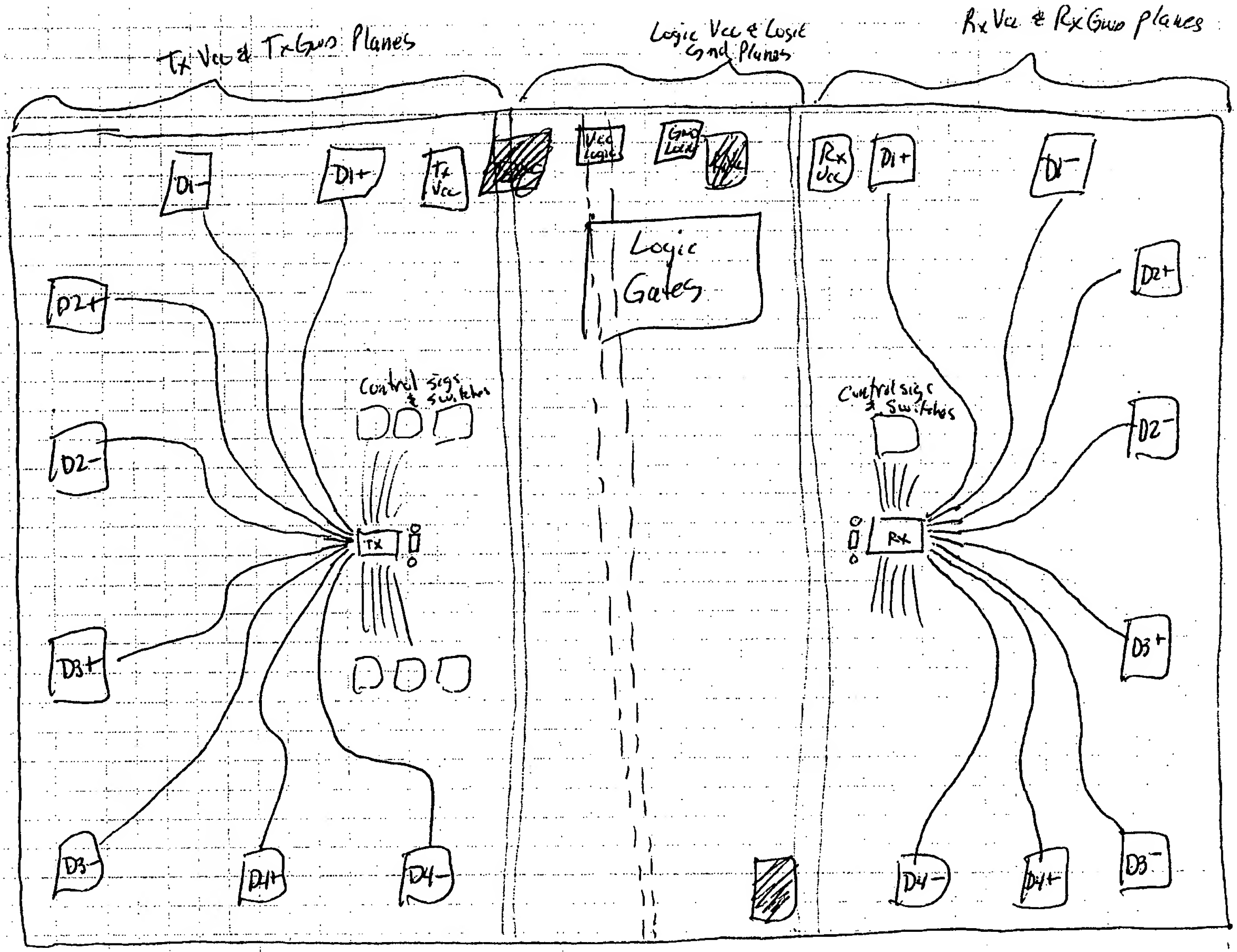
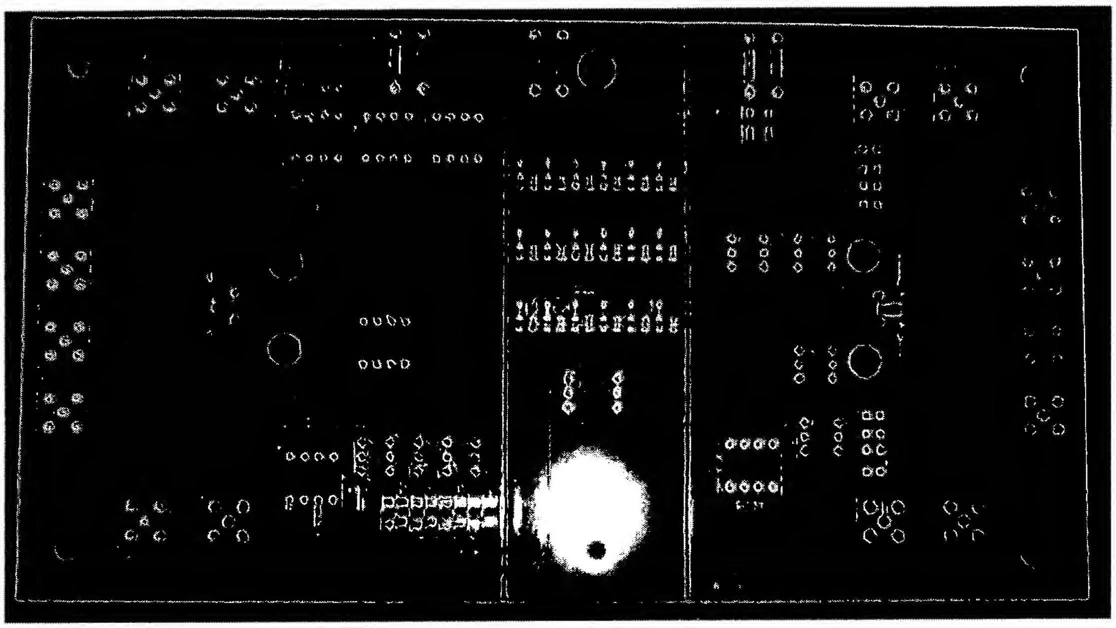

Tx Vcc & Tx Gnd Planes
Logic Vcc & Logic Gnd Planes
Rx Vcc & Rx Gnd planes
D1−
D1+
Tx Vcc
Vcc Logic
Gnd Logic
Logic Gates
Rx Vcc
D1+
D1−
D2+
D2−
D3+
D3−
D4+
D4−
Control sigs & Switches
Tx
Rx
D2+
D2−
D3+
D3−
D4+
D4−
Control sigs & Switches

EXHIBIT B



<u>EXHIBIT C</u>

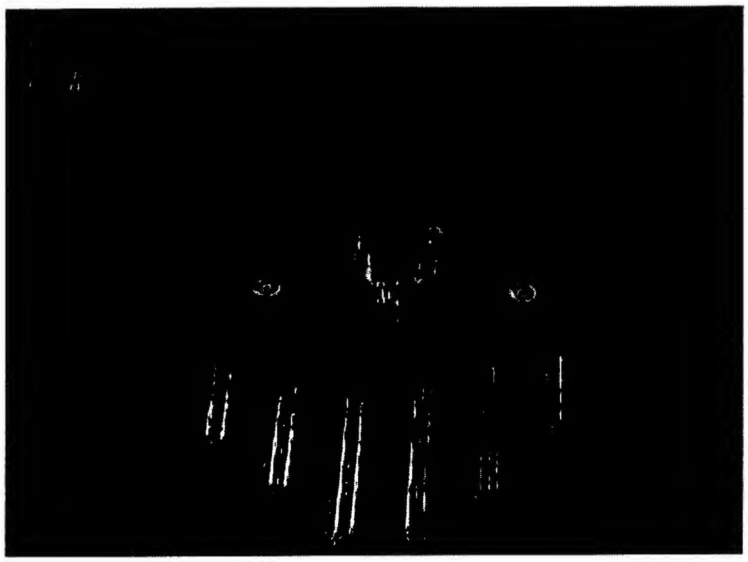


EXHIBIT D

TX eye of Open Fiber Control - Message (HTML)

File Edit View Insert Format Tools Actions Help

Type a question for help

Reply | Reply to All | Forward

From: IMCEAEX-_O=AGILENT_OU=AMERICAS_CN=RECIPIENTS_CN=AM-190381@exch.agilent.com

Sent: Thu 1/25/2001 5:58 PM

To: janet_yun@agilent.com

Cc: fred_miller2@agilent.com

Subject: TX eye of Open Fiber Control

Attachments: 1Gbaud_500mv.gif; 2.5Gbaud_500mv.gif; 500Mbaud_500mv.gif

Hi,

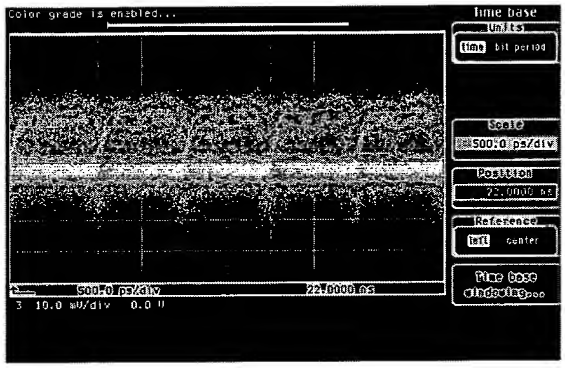
Attached are the electric eyes of a TX channel of the Open Fiber Control board. The amplitude of the input data signal is 500mV. The output light is connected to a New Focus 1554 photo-detector and then AC coupled to the oscilloscope. The eyes are extremely noisy due to very high bias current (20mA per channel) and New Focus 1554 is renowned to be noisy as well. Nevertheless, TX seems to be working OK.

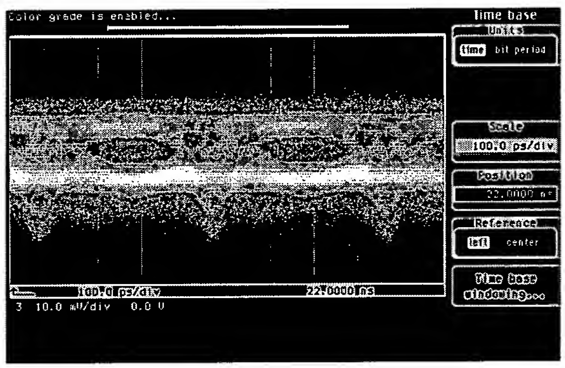
Jing

<<1Gbaud_500mv.gif>> <<2.5Gbaud_500mv.gif>> <<500Mbaud_500mv.gif>>

```
>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>
Jing Wang, Ph.D.                   >
Hardware Design Engineer           >
Fiber Optic Communication Division >
Agilent Technologies               >
Phone:                             >
                                   >
<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<
```

EXHIBIT E


Color grade is enabled...
Time base
Units
time bit period
Scale
500.0 ps/div
Position
Reference
left center
Time base windowing...
500.0 ps/div
22.0000 ns
3 10.0 mV/div 0.0 V


Color grade is enabled...
Time base
Units
time bit period
Scale
100.0 ps/div
Position
Reference
left center
Time base windowing...
100.0 ps/div
22.0000 ns
3 10.0 mV/div 0.0 V

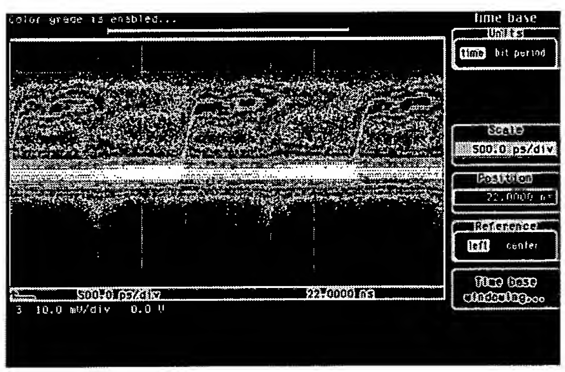

Color grade is enabled...
Time base
Units
time bit period
Scale
500.0 ps/div
Position
Reference
left center
Time base windowing...
500.0 ps/div
22.0000 ns
3 10.0 mV/div 0.0 V

EXHIBIT F

RX output - Message (HTML)

File Edit View Insert Format Tools Actions Help

Type a question for help

Reply | Reply to All | Forward

From: IMCEAEX-_O=AGILENT_OU=AMERICAS_CN=RECIPIENTS_CN=AM-190381@exch.agilent.com

Sent: Tue 1/30/2001 4:40 PM

To: janet_yun@agilent.com

Cc: fred_miller2@agilent.com

Subject: RX output

Attachments: rx3125g.gif

Hi, Janet:

Fred and I held a telephone conference with Jurg Willa of Helix AG on our difficulty of getting enough signal out of the RX of the Open Fiber Control module this morning. The conference meeting was very constructive. We provided the problem and testing data while Jurg gave back analysis, and we came to the conclusion that the problem is with the wire-bonding of the IC, quite probably with the V0ref connection.

The problem has been corrected. The measured output eye diagram at 3.125G while manually launching modulated light onto one of the photo-detector is attached. It's a bit too noisy with a swing of about 300mV that is within the range of the IC spec. The noise might be because only one channel is activated and tilted the load for each channel.

Next, we are gonna put on the OSA on the RX and finish the whole board assembly and demonstrate OFC.

<<rx3125g.gif>>

Jing


```
>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>
Jing Wang, Ph.D.                   >
Hardware Design Engineer           >
Fiber Optic Communication Division >
Agilent Technologies               >
Phone:                             >
                                   >
<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<
```

EXHIBIT G

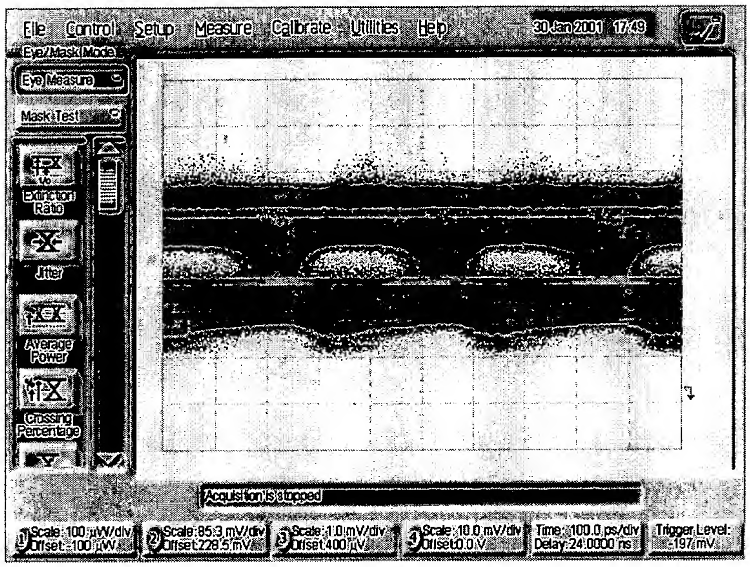

File Control Setup Measure Calibrate Utilities Help
30 Jan 2001 17:49
Eye/Mask Mode
Eye Measure
Mask Test
Extinction Ratio
Jitter
Average Power
Crossing Percentage
Acquisition is stopped
Scale: 100 µW/div
Offset: -100 µW
Scale: 85.3 mV/div
Offset: 228.5 mV
Scale: 1.0 mV/div
Offset: 400 µV
Scale: 10.0 mV/div
Offset: 0.0 V
Time: 100.0 ps/div
Delay: 24.0000 ns
Trigger Level:
-197 mV

EXHIBIT H

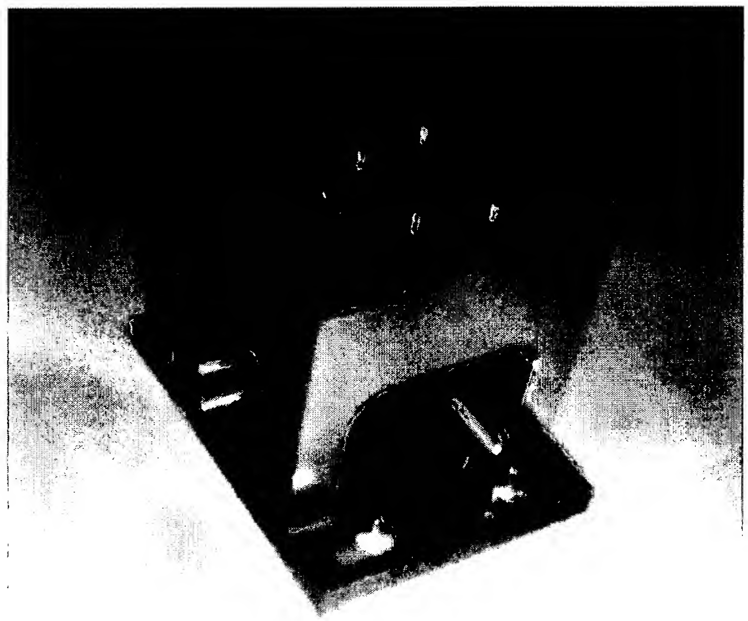


EXHIBIT I

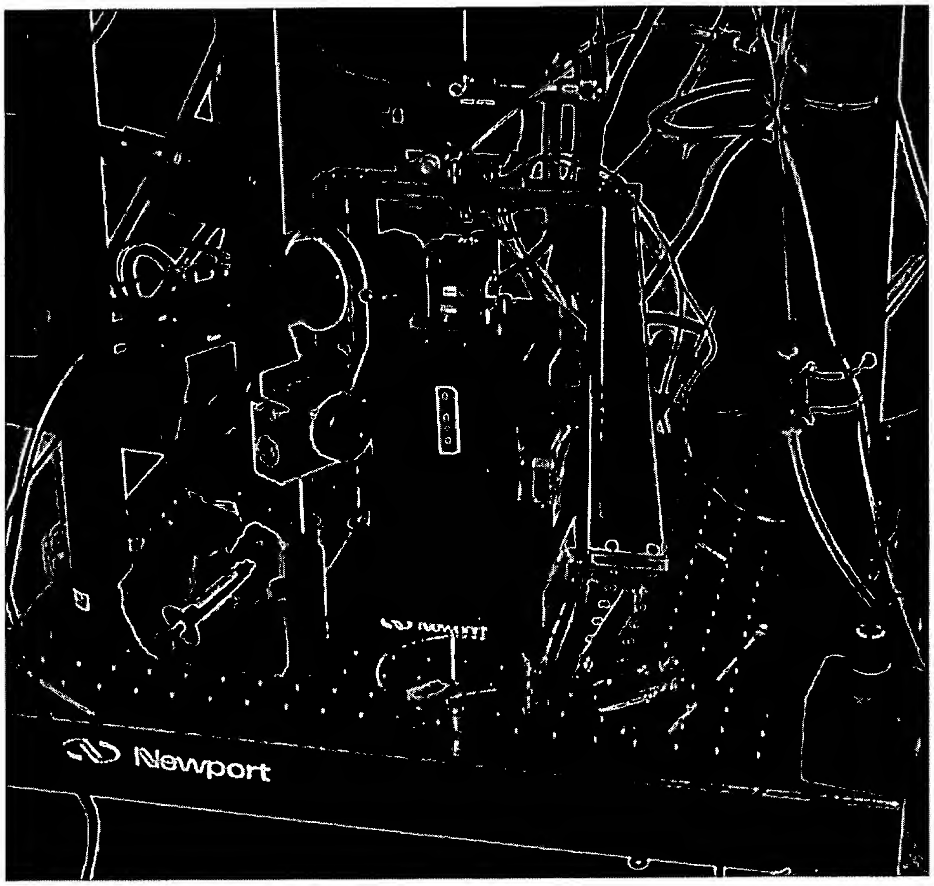


EXHIBIT J

Implementation of Agilent Open Fiber Control

---*Jing Wang*, *Fred Miller*, and *Chris Ocampo*

Open Fiber Control (OFC) is an attractive scheme designed to overcome the mandatory eye-safety limit on the transmission power of optical transceivers. Agilent has devised an implementation that accomplishes OFC all in the PHY layer for multi-channel applications including parallel and Wavelength Divisional Multiplexing (WDM) that use ribbon fiber cable and MTP connectors. In this report, an introduction to OFC and its merits is first briefed. The Agilent design is then disclosed, and finally its board-level implementation and testing are presented along with a successful OFC functionality demonstration.

I. Introduction

In the last decade, we have witnessed a revolution in telecommunication fueled by the explosion in Internet usage and the ever-growing demand in bandwidth. Optical solution has provided the ways and means. High throughput and long-fetching transceivers are in high demand, in particular, in the fast-growing local-area-networking (LAN) such as Gigabit Ethernet (GbE) and 10 GbE, and the emerging storage-area-networking (SAN), e.g., Fiber Channel (FC). In developing high-speed transceivers for Ethernet and FC, higher transmitted optical power is almost always desirable, and sometimes necessary in extending connection distance, lowering receiver sensitivity, and using simpler optics etc. The availability of higher power laser sources certainly has provided us with this luxury. However, there is also the eye-safety concern, in particular, in the short wavelength of 850nm. The class 1 eye-safety optical power limit (~-4dBm at 850nm), imposed by standard bodies IEC and CDRH, has to be met. Although the newer IEC limit has increased the limit at 850 by nearly 80%, eye-safety limit is still one of the main obstacles, especially in multi-channel transceiver development where the total optical power of all channel combined has to satisfy the safety limit. There are several ways to get by this stringent safety limit and OFC is one of the most attractive options.

OFC is initially proposed and implemented in the transmission layer in the FC protocol FC-PH, but eliminated in later versions of FC due to timing incompatibilities. The basic concept of OFC is illustrated in **Fig. 1 & 2**

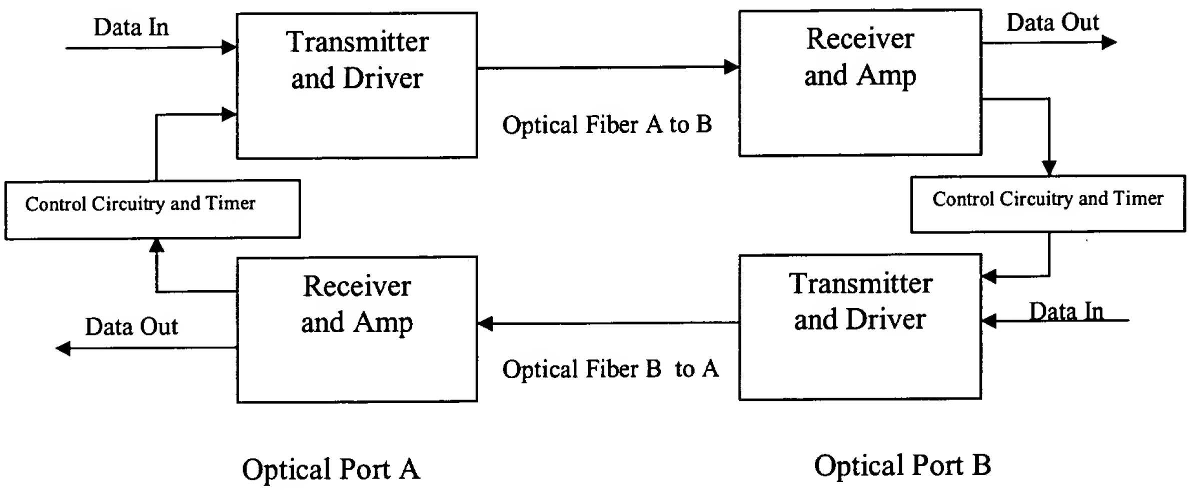
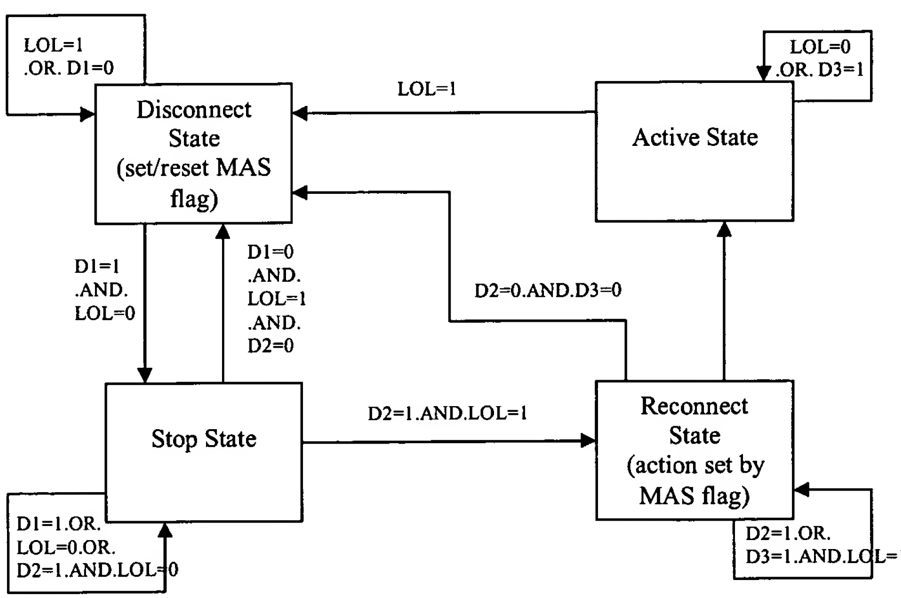


Fig. 1. Block Diagram of the OFC system.



Definition: LOL = loss of light (asserted = 1, de-asserted =0)

MAS = Master of reconnection flag

D1 = Decode 1, first time period flag = link check (linked = 1)

D2 = Decode 2, second time period flag = Disable laser (disabled = 1)

D3 = Decode 3, third time period flag = link check (linked = 1).

Fig. 2. OFC system State Diagram.

Circuitry and timer are embedded in the transceiver to detect the loss of signal due to breaks in the link and shut down the transmitter subsequently within a short period of time (mini-seconds). In the active state when transceivers are under normal operation, the transmitted power can be higher than the eye-safety limit. In the meanwhile, FC-PH issues periodic special decoded signal (low power short pulses) in synchronization with the master port of the FC loop to reestablish the connection when the links are reconnected.

In practice, however, transceiver vendor found that the synchronization of MAS set/reset and the Decodes is quite difficult to achieve at different link lengths, especially at long distances. In combination with less stringency in power budget and receiver sensitivity at low-data rate transceiver development, OFC, despite its advantages, is abandoned as a whole. Only recently, under much tighter power budget in developing high-speed modules such as 4+4 at 3.125Gbps and 10Gbps serial, people started to revisit OFC. The common sentiment in various standard committees including 10GbE and FC is to make OFC optional, but it might change with the increase in data rate of transceiver modules and become a necessity.

II. Agilent Design

Agilent's design gets by the timing issue by implementing OFC purely in the PHY layer, using the fact that receivers have to detect sufficient amount of optical power to prove a legitimate good link and simple hardware to control the transmitter. It gets rid of the requirement of FC-PH issuing special decodes to reestablish the link. The demo here is for a 4 channel

parallel link, but the idea can be easily modified for other applications such as 10Gbps serial. Fig. 3 is the block diagram of Agilent implementation. The state machine is as following:

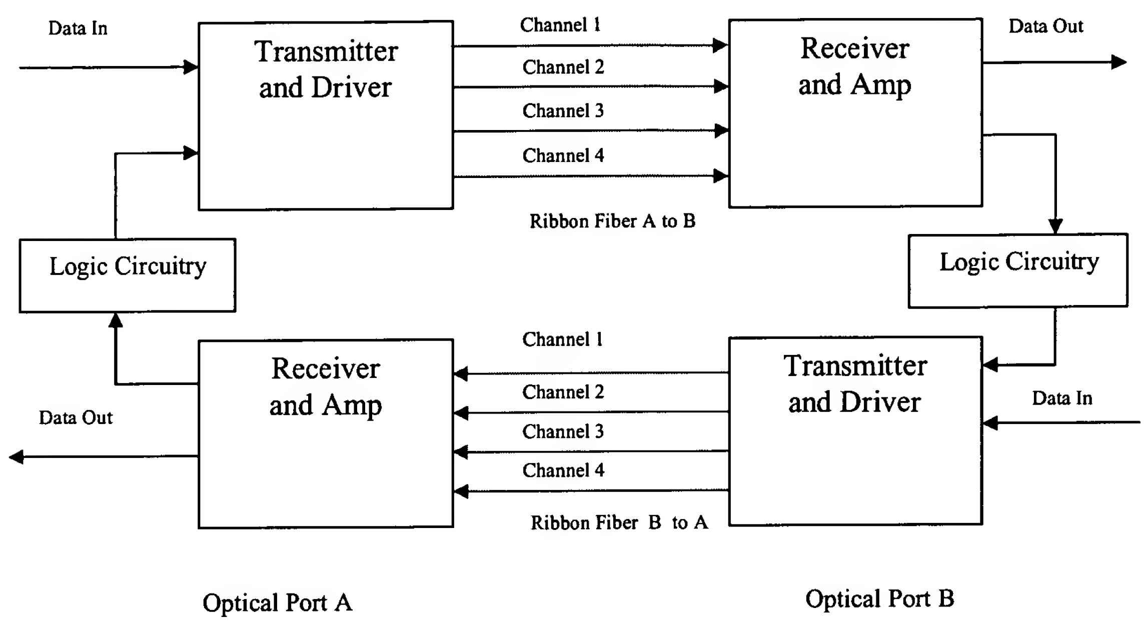


Fig. 3. Block Diagram of Agilent OFC.

(1) Active state: Ribbon fiber cables are plugged in and two modules are all powered up. All the 4 transmitters of each module will all be enabled and transmit normally at -4dBm per laser. Clearly the total output power (~2dBm) out of the male MTP connector would exceed the class 1 eye-safety limit, but it would not matter since the links are closed.

(2) Disconnect State: When one of the ribbon fiber cable is unplugged (including the corresponding transmitter or receiver being powered off), e.g. Rx A, Rx A will receive no signal, and the logic circuitry will then disable 3 of the transmitters in Tx A and leave only one (which can be arbitrarily designated, e.g. Tx A2) continuing operating. Rx B will then sense the change in Tx A and disable 3 of the transmitter in Tx B and leave only Tx B2 emitting at a transmission power of -4dBm, thus, the optical power at the break point, which is the output of male connector at Rx A, will be eye safe. The time scale of these responses should be mini-seconds.

III. Board-level Testing

The above idea is implemented and a demo system is built. Fig. 4 (right) is a partial realization of Fig. 3 with only Tx A&B and Rx A, and a close-up of Tx A and Rx A board (left).

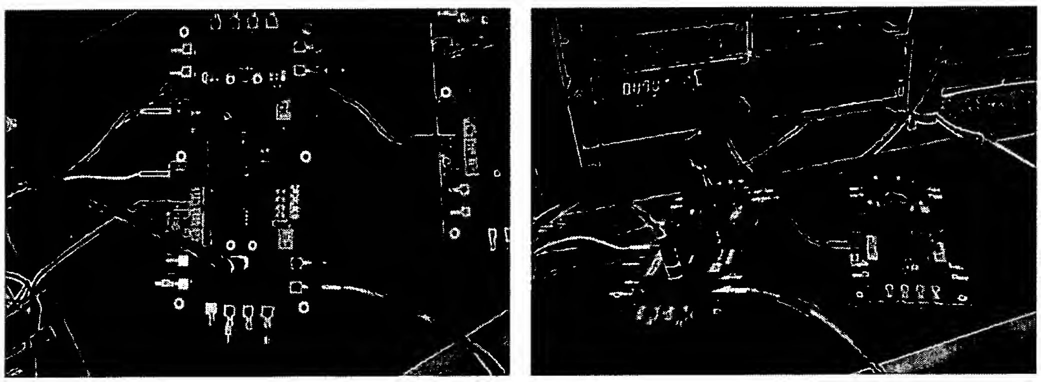


Fig. 4. Image of Agilent OFC boards and evaluation set-up.

The transmitters use the middle 4 channels of POPEYE 1x12 mode VCSEL array driven by a Helix AG 4-channel VCSEL driver HXT2204 that can be operated up to 3.125Gbps/ch. The receivers are comprised of the middle 4 channels of POPEYE 1x12 PiN array with Helix AG receiver HXR2204 which can also receive a data rate up to 3.125Gbps/ch. ICs are wire bonded to the evaluation board. The inputs and outputs are AC differentially coupled through SMA connectors. 1x12 flat ribbon fiber cable with MTP connectors is used to do the linking. Fig. 5 illustrates the alignment of transmitters, whereas the alignment for Rx is the same but light traveling the opposite direction.

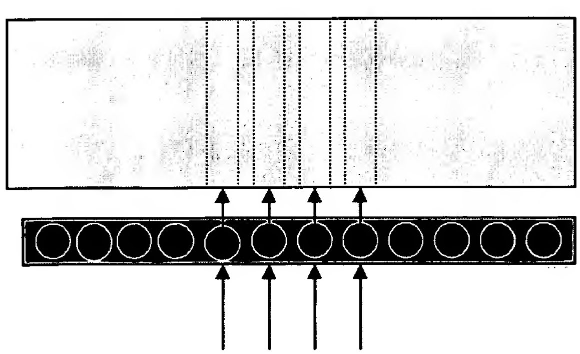
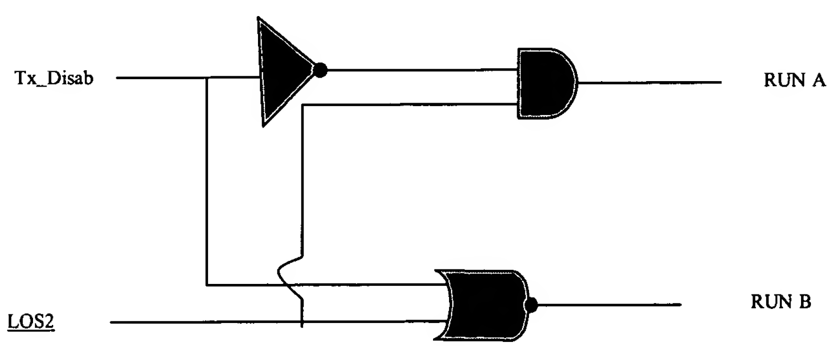


Fig. 5. Optical alignment at Tx.

The OFC logic block (the central portion on Fig. 4 left picture) is assembled with CMOS logic gates from Fairchild Semiconductor ™. The list is as

NC7S04	TinyLogic™ HS Inverter
NC7S08	TinyLogic™ HS 2-Input AND gate
NC7S02	TinyLogic™ HS 2-Input NOR gate
NC7S00	TinyLogic™ HS 2-Input NAND gate

The functionality of the block can be reduced to that of Fig. 6



Fug. 6. Schematic of Agilent OFC logic block. RUN A and RUN B are used to enable or shut down transmitters.

Txs, Rxs, and the logic block are powered by a DC power supply through banana sockets at 3.3V. In addition, Dip switches are put on the board to adjust bias, Imod etc., scope probes to test voltages and currents at interested points to help debug the layout, and surface-mounted LEDs to indicate the status of Txs and Rxs.

The test is first carried out on the transmission of Tx and Rx. This is done on a single board using a ribbon fiber cable to link the Tx and Rx. Fig. 7&8 are the results

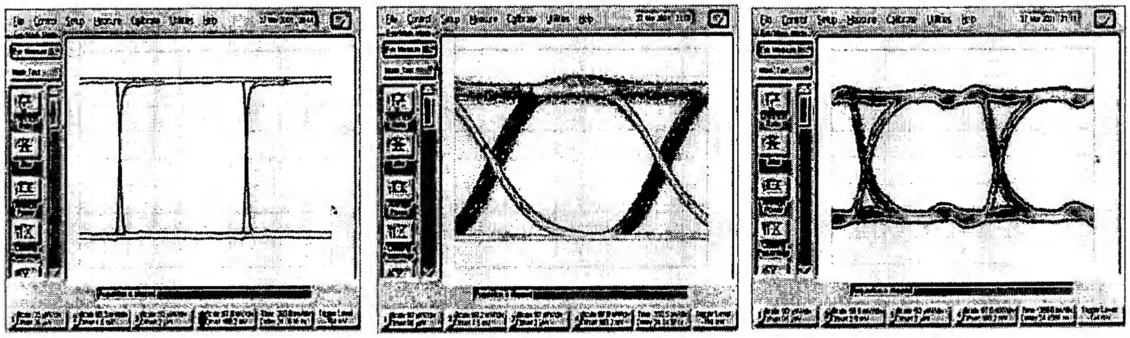


Fig.7. Eye diagrams of input electrical signal to Tx (500mV swing, 32 bits PRBS), optical output of one of the 4 channels, and electrical output at Rx (from left to right). The data rate is 1Gbps.

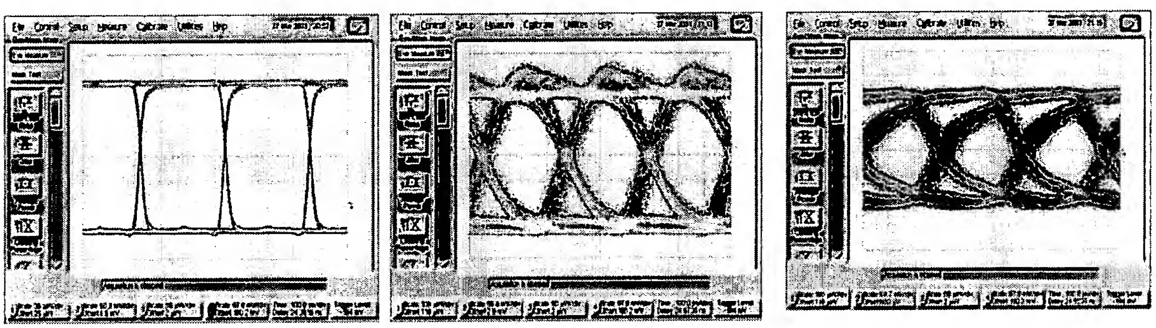


Fig. 8. Eye diagrams at 3.125Gbps.

At data rates of 1Gbps and 3.125Gbps respectively. Due to paracities introduced in our board layout and assembly, e.g. some long wires had to be used to bond the Helix ICs. The transmission characteristics are not ideal at 3.125Gbps to IC's full potential.

Secondly, OFC is demonstrated with two boards. A ribbon fiber cable (MTP-to-MTP) is used to link Tx B and Rx A (please refer to Fig. 3 and Fig. 4 right) and another ribbon fiber cable (MTP-to-SC) to observe the output of Tx A. Power up all the Txs, Rxs and the logic block on board A, the observations are:

(1) When Tx_Disable is set high manually (use a jumper to jump Tx_Disable to V_{CC}), all but transmitter 2 of Tx A are disabled no matter Tx B and Rx A are connected or not.

(2) Connecting Tx B and Rx A and jump Tx_Disable to low (jump Tx_Disable to GND), all transmitters are functioning with an output power of 250μW per channel.

(3) Unplugging either Rx A or Tx B or simply power off Tx B, channel 1,3 and 4 stop emitting in about 1 second, but channel 2 continue functioning with the same optical output power.

(4) Re-plugging in what unplugged in (3), all 3 disabled channels resume functioning in matter of mini-seconds.

In summary, the Agilent OFC demonstrated full functionality of open fiber control. The slower than expected laser shutoff-time is due to paracities introduced in our board layout and assembly and should be able to easily corrected.

IV. Conclusions and Comments

In today's transceiver development, OFC is making a serious comeback to help develop high-speed modules. It helps to overcome the mandatory international eye-safety limitations and provide transceiver developers more room in the power budget to work with, which can allow us use simpler optics, lower sensitivity receivers that greatly reduce cost and development cycle, and extend link reach as well.

One of the key obstacle that has made transceiver vendors shun away from implementing OFC is the complication associated with timing synchronization in initial OFC systems that use special decodes in the transmission to reestablish linking. However, we have shown that OFC can be done purely with hardware.

Our demo is for 4-channel parallel application, but with simple modification, it can be used on serial as well. The feedback from the logic block can be used to control the bias current of the transmitter, for example, to lower the optical output power in case of a mis-wiring. As we are aware of, the power budget in VCSEL based 10Gbps serial with multi-mode fiber will be extremely tight. Future effort and consideration of employing OFC to open up the power budget margin is definitely worthy.

EXHIBIT K

RE: IP Meeting - Friday, 4/6/01 - Message (HTML)

File Edit View Insert Format Tools Actions Help — Type a question for help

Reply | Reply to All | Forward

From: IMCEAEX-_O=AGILENT_OU=AMERICAS_CN=RECIPIENTS_CN=AM-190381@exch.agilent.com — Sent: Thu 4/5/2001 5:00 AM

To: pamela_kee@agilent.com; janet_yun@agilent.com; fred_miller2@agilent.com; roland_haitz@agilent.com; george_girot@agilent.com; chris_ocampo@agilent.com

Cc: pam_pinkston@agilent.com

Subject: RE: IP Meeting - Friday, 4/6/01

Attachments: Open Fiber Control.doc (1 MB)

Hi, all:

Attached is a report of our work on demonstrating Open Fiber Control for your reference before our scheduled IP meeting this Friday.

Regards,

Jing

<<Open Fiber Control.doc>>

```
>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>
Jing Wang, Ph.D.                    >
Hardware Design Engineer            >
Fiber Optic Communication Division  >
Agilent Technologies                >
Phone:                              >
                                    >
<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<
```